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ABSTRACT

An intervention project concerned with the education of very young, disadvantaged children in an attempt to prevent intellectual deficits in "high-risk" children is presented. The intervention technique employs an intensive educational program for the very young high-risk child, beginning before six months of age. Using survey data, a maternal IQ was designated the basis for selection of a group of newborns. A two-phase program was initiated to prepare the mothers for employment opportunities and to improve their homemaking and child-rearing skills. An infant stimulation program was also implemented. The program was designed to facilitate intellectual development of very young children. It is concerned with (1) physical location which promotes learning, (2) a staff to manage and arrange instruction for children, and (3) the educational program. Development was assessed by an intensive schedule of measurements, including measures of physical maturation, standardized and experimental measures of developmental schedules of infant adaptive behavior, tests of general intelligence, an array of experimental learning tasks, measures of motivation and social development, and measures of language development. The success of this program requires an active community service program for which there is no previous model. (CK)

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THE MILWAUKEE PROJECT: EARLY INTERVENTION AS A TECHNIQUE TO PREVENT MENTAL RETARDATION

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Howard Garber and Rick Heber are professors at the University of Wisconsin. Their research specialties are learning disabilities. The Milwaukee Project is one of the most important longitudinal studies ever undertaken and it has yielded heartening results. For many poor children, early education of a nursery school variety can overcome mild ravages wrought by poverty. For others, however, those born into grinding poverty to mothers with severely limited maternal teaching skills, the usual preschool is too little and too late. Structured cognitive instruction must begin for these children in the cradle. The Milwaukee Project shows that the intellectual potentials of children don't have to be mangled by poverty and ignorance of parents. Cradle Schools can become an effective intervention mechanism to save them from this fate. The Milwaukee Project will be replicated widely as community agencies focus more clearly on specific needs for intervention to prevent school failure.

The evidence that a certain population of disadvantaged children suffer depressing events through the early years is derived from the performance discrepancy typically exhibited between them and their counterparts, the "normal, middle-class, advantaged child." Virtually all the studies of such early "deprivation" have attempted to ameliorate the intellectual deficiency that seems to attend developmental disadvantagement by using some sort of enrichment or compensatory education procedure. The enrichment procedure is intended to intellectually rejuvenate children who have been deprived of the stimulation appropriate for intellectual development. Moreover, it seemed entirely reasonable to attempt to close the performance gap for these children by implementing a "catch-up" compensatory program just prior to the time the children enter school.

Unfortunately, most gains in performance proved tenuous, as the discrepancy between the children reappeared after a few years of schooling. It appears that most of these attempts to rehabilitate the developmental process for such children did not begin intervention early enough to mitigate whatever depressing events occur most powerfully in the early environment, particularly since nearly all began after most of the critical periods. The human organism is an extremely complex organism and therefore cannot be expected to respond normally when the appropriate stimulation necessary for growth is not available. There is, rather, a biologically related sequence of critical periods in early life at which times both optimum nutrition and stimulation must be available—i.e., if development is to be normal.

There are both strong and weak aspects to this notion of compensation which is known more generally by the rubric: *social deprivation hypothesis.* Its strong points are that it has provided intellectual and nutritional benefits to otherwise disadvantaged children; and probably its strongest point is that it has helped children to adjust emotionally and attitudinally to the requirements of formal schooling, particularly since a major problem with the education of the disadvantaged in elementary school has been one of motivation, discipline, and maintenance of classroom decorum. The weak point is the fallacious notion that compensatory education would be a panacea for children with severe developmental histories.

The Milwaukee Project is at once similar in concept to the early education studies, but it is also *quite* different. It is because of its outward similarity that the difference in concept and design between the Milwaukee Project and other "early education studies" could be overlooked and even confused. True, the project is an intervention project concerned with the education of very young children who are quite disadvantaged: but the Milwaukee Project is much more than that.

The Milwaukee Project, as it has come to be known, represents an attempt to prevent intellectual deficits in "high-risk" children by early intervention. The intervention technique employs an intensive educational program for the very young high-risk child, beginning before six months of age. The label "high-risk" is a statistically based term which reflects that certain children have a critically high probability of being mentally retarded by the time they have reached maturity. This probability level is determined by a number of factors which include low maternal IQ, low SES,

PS 006644

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low IQ of siblings, large-sized families, etc. Evidence from extensive survey work showed that the offspring of mentally retarded, low SES mothers, although testing at retarded levels on IQ instruments at maturity, test at normal levels very early in life. *The Milwaukee Project undertook to prevent this decline from occurring by having a group of children participate in an intensive early education program, beginning before six months of age.*

It is just this point that may not be well understood. The Milwaukee Project was designed as a study to prevent mental retardation — cultural-familial mental retardation — by intervening very early in life. The study was not designed to raise IQ levels, but to permit continued normal intellectual development by mitigating environmentally depressing events. Perhaps it would be helpful to digress in order to follow how the Milwaukee Project came about and the progress made to date.

Approximately ten years ago, faced with problems associated with early detection of mental retardation, the University of Wisconsin Research and Training Center established the High-Risk Population Laboratory. The main purpose of this effort was to provide opportunity for prospective longitudinal investigation into the problems of mental retardation, in contradistinction to the almost exclusive reliance upon retrospective techniques. Further, the intent of the laboratory was to bring into accessibility for research purposes the sub-population of the mentally retarded labelled the cultural-familial retarded, which previously has been essentially unavailable to investigators. This group of retarded reside in the community and remain undetected for two reasons: (1) they have relatively mild intellectual deficits which are most difficult to detect in the very young; and (2) they are without major related physical problems. Ordinarily, neither of these characteristics alone would be sufficient to precipitate the attention of responsible agencies to these individuals.

The approach used by the High-Risk Population Laboratory in its search for a technique for early detection was to develop sufficient information to permit the diagnosis of cultural-familial retardation. In order to compile this information, a door-to-door survey was conducted in an area of the metropolitan community of Milwaukee which had previously been identified as having an extremely high prevalence of retardation. This area of the city has the lowest median educational level, the lowest median family income, the greatest population density per living unit, and the highest rate of dilapidated housing in the city. *Though the area comprises about 2 percent of the population of the city, it yielded approximately 33 percent of the total number of children identified in school as educable mentally retarded.* In our first survey, all families residing in this area who had a newborn infant and at least one other child of the age of six were selected for study. All members of the family, both children and adults, received an individual intellectual appraisal. In addition, extensive data were obtained on family history, including the social, educational and occupational history and status. This approach provided us with some key variables that appear to be sufficiently sensitive to the existence of cultural-familial retardation to be used as a signal for such.

The population survey data produced some striking data on the prevalence of retardation in depressed urban areas, on the distribution of retardation among families living in the high-risk area, and on trends in intelligence as a function of age of children and adults residing in the area. *For example, it was found that the high prevalence of mental retardation identified with Milwaukee's inner core population was strikingly concentrated among families where maternal intelligence was depressed, particularly where the family was large.* From our survey sample it was found that the prevalence of IQ's of 75 and below was 22 percent, i.e. in these families where there was a newborn and at least one child of age six or greater. This selection procedure resulted in a sample of much larger than average families, and an increased prevalence of sub-75 IO's. However, it was found that 45.4 percent of the mothers who had IQ's below 80 accounted for 78.2 percent of all children with IQ's below 80. Moreover, it was found that depressed maternal intelligence was even a better predictor of depressed child intelligence for the older (above age six) than for the younger children. The most startling aspect of this data is that on infant intelligence tests, children of mothers above 80 IQ and below 80 IQ did about equally well. *After the infancy period, though, the children whose mothers had IQs greater than 80 appeared to maintain a fairly steady intellectual level, while the children whose mothers had IO's less than 80 exhibited a marked progressive decline in their intellectual level.* [See Figure 1] This trend toward a decline in measured intelligence for children in disadvantaged environments has wide acceptance as a general characteristic of a "slum" environment population, although this set of data indicates that this trend of declining intelligence as age increases is restricted to offspring of the "less bright" mothers.

Selection of Research Families:

As a consequence of the survey data, we have utilized maternal IQ as a basis for selection of a group of newborns, with confidence that a substantial percentage would be identified as mentally retarded. In other words, to identify the "high-risk" families within the "high-risk" residential area, the variable of maternal intelligence was utilized as a selection criterion since it proved to be the most efficient predictor of low school-age offspring intelligence.

The High-Risk Population Laboratory maintained a survey of births in the high-risk area. By first screening and then administering individual tests of intelligence, we identified those mothers of newborns who are mentally retarded, i.e. who had full-scale WAIS IQ's less than 75. From this pool of candidates, accumulated over an eighteen month period, we drew 40 mentally retarded mothers and randomly assigned them to either the Experimental or Control condition, after they had been invited to participate in a study of child development being conducted by the University of Wisconsin. All of the families selected were of Negro extraction.

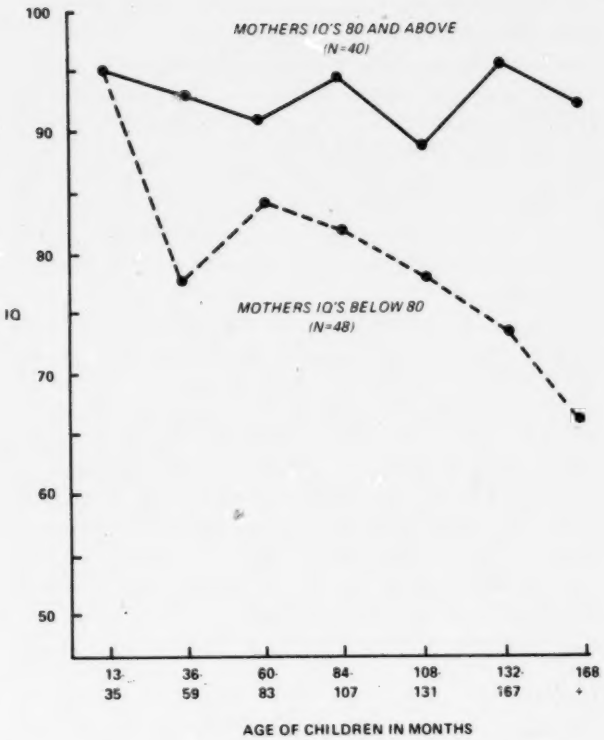


Figure 1. IQ Change in the Offspring of Disadvantaged Mothers as a Function of Maternal IQ (Heber, et al., 1968).

The Experimental group, beginning within the first few months of life, was to undergo a comprehensive intervention in their social environment, the objective of which was to displace all of the presumed negative factors in the social environment of the infant being reared in the slum by a mother who is herself retarded. We are thereby, testing the "social deprivation" hypothesis of etiology by seeing whether it is possible to prevent retardation from occurring in the offspring of these retarded mothers.

Should the Experimental children enter school and exhibit normal intellectual functioning we will know that it is possible, through our experimental program, to prevent mental retardation from occurring at the present high frequency of children raised in these circumstances. If the children are assigned to classes for the retarded at the rate of those without training, our program has not been successful.

The experimental intervention is comprised of two components: (1) the maternal rehabilitation program and (2) the infant stimulation program which are described below.

THE MATERNAL REHABILITATION PROGRAM

A two phase program was initiated to better prepare the experimental mothers for employment opportunities and to improve their homemaking and child-rearing skills. Through improved employment potential, increased earnings, and self-confidence, it was hoped that positive changes in the home environment would occur. The rehabilitation program consisted of adult education classes to teach the mothers basic academic tools necessary for vocational adaptability, and finally, an occupational training program to teach specific vocational skills.

The job training program utilized two large, private nursing homes in Milwaukee. The choice of the nursing homes as a site for training was made because of the appropriate job skill areas represented in these facilities, the availability of professional staff with some understanding of rehabilitation problems, and the employment opportunities available in nursing homes and other chronic care facilities.

During the educational phase of the program, the basic academic skills of reading, writing and arithmetic were emphasized. In addition, their curriculum included community oriented social studies, home economics, interpersonal relations, and child care.

While the occupational habilitation component of the maternal program appears to have been quite successful to date, major problems with respect to adequacy of homemaking skills and care and treatment of children remain to be resolved with a number of experimental families. With many of the mothers now successfully employed, the maternal program is shifting to an increased emphasis on training in general care of family and home, budgeting, nutrition, and food preparation.

THE INFANT STIMULATION PROGRAM

The program is, in its most basic sense, designed to facilitate intellectual development of very young children. The plan is concerned with (1) a physical location which promotes learning, (2) a staff to manage and arrange instruction for children, and (3) the educational program.

Physical Plant:

Over the years, the project has been located in several facilities. When all of the children were around six months of age, a large fourteen room duplex served our needs very well because of the many "nooks and crannies" where teachers could work with children on a more intimate one-to-one basis.

Later, when the children became increasingly mobile, a portion of the project was moved to a nearby Salvation Army Center. This afforded a large open space for gross motor activities, as well as several adjacent rooms for quiet instruction. The entire program is now housed in a leased school facility located adjacent to one of the inner-city's churches. This building, complete with six classrooms, a gymnasium, office space, and a lunch room is well suited to the needs of the program.

The Staff:

At the onset of the stimulation program we chose to employ a para-professional staff. The persons chosen were,

in our judgment, language facile, affectionate people who had had some experience with infants or young children. The majority of these "teachers" resided in the same general neighborhood as the children, thus sharing a similar cultural milieu. The teachers ranged in age from approximately eighteen to forty-five with most of the teachers in their mid-20's. Their educational experience ranged from eighth grade to one year of college. The teachers were both black and white.

The teacher of an infant had the major responsibility of establishing initial rapport with the infant's mother. This was done during a brief period, ranging from two to eight weeks, when the teacher worked with her child in the home until the mother expressed enough confidence in the teacher to allow the child to go to the center.

Since the responsibilities of the teachers were diversified and demanding, an on-going training program was employed. The most important aspect of this program was the in-service training. Each infant's teacher was given help in organizing her day into blocks of time which included physical care and comfort as well as instructional blocks, for which she was provided with activities appropriate for her child. Each teacher was observed and evaluated frequently by a curriculum supervisor. Issues relating specifically to that teacher such as choice of activity, attitude toward the child, time spent in talking to the child, observation and evaluation were discussed privately with her. General problem areas were discussed with the entire group. During this time, problems were brought up both by the curriculum supervisor and the teachers.

As the children became older and teachers mastered one subject area under the direction of the curriculum supervisors, specific activity lists became unnecessary, except as guidelines or suggestions. In fact, teachers became quite competent in designing goal specific tasks independently. Group meetings continued to be valuable for exchanging ideas and helped to keep teachers on target in their academic areas. Over the years, such problems as toilet training, thumb sucking, 360 ways to teach colors, discipline, and children's rights have been discussed. More abstract topics such as how a teacher's attitude toward school may affect the child's attitude, ways a teacher transfers her attitudes, children's concepts of work and play within the learning environment, capitalizing on learning from peers, have also been brought up for discussion. This type of on-going training has been extremely valuable and necessary.

Educational Program:

When the children first entered the project (by six months of age), they were each assigned a teacher. If the match proved satisfactory, the child remained with her as his primary teacher until he reached twelve months of age. At that time the child was gradually paired with other teachers and children. By the time he was fifteen to twenty months old, depending on the child, he was grouped with two other children and came into contact with three different teachers. This situation holds for just his academic-learning environment. Actually each child was in contact with most of the other children and teachers.

The teacher who was assigned to an infant was responsible for his total care, including: feeding and bathing, cuddling and soothing, reporting and recording general health as well as organizing his learning environment and implementing the educational program. Within the context of the educational program, the teacher was expected to follow and expand upon a prescribed set of activities. Her job was to make these activities interesting, exciting and varied. She was also required to "objectively" evaluate and report the child's progress, pointing out areas of apparent difficulty.

The present groupings and teacher-pupil ratios vary with the age level of the child, but are flexible to allow for individual child needs. Under most circumstances, the infant remained with a teacher on a one-to-one basis up to twelve months, at which time another teacher and child were paired with him to encourage the expansion of relationships. Around fifteen months of age, a transition period began during which two children were assigned to one teacher. By age eighteen months we began to form the children into small groups so that by about 24 months all children of the same age level (about a five month span) were grouped together with enough teachers to provide a one-to-three teacher-child ratio. During structured learning periods, the teacher-pupil ratio may be 1:2, 1:3, 1:4 depending upon the age and the ability of the children. Within each age group, behavioral and educational evaluations were made by the teachers, teacher supervisor, and curriculum supervisors in bi-monthly conferences, at which time decisions on whether to regroup children, provide individual instruction or curriculum changes were made.

To facilitate learning and teacher effectiveness, a structured program was planned for each age group. The schedule remained constant to aid the child in developing realistic expectations and time orientation. For children under 24 months of age, the teacher varied the schedule in consideration of the child's moods and attention, while teachers of children older than 24 months followed the schedule somewhat more closely, gradually increasing the demands made on the child's attention span. The daily schedule for each child was as follows:

8:45	Arrival
9:00–9:30	Breakfast
9:30–10:00	First structured learning period
10:00–10:30	Second structured learning period
10:30–11:00	Self-directed activities in free play environment
11:00–11:30	Third structured learning period
11:30–12:00	Sesame Street
12:00–12:30	Lunch
12:30–1:45	Nap
1:45–2:00	Snack
2:00–2:30	Fourth structured learning period
2:30–3:00	Fifth structured learning period
3:00–3:30	Sixth structured learning period
3:30–4:00	Motor period
4:00	Departure

Though a child was never forced to remain in a learning area, the teacher was encouraged to make it exciting for him to do so.

When there were three intact groups, each of the three staff members for each group taught one of the morning academic areas. During the course of the morning, the children moved in their small instructional groups (2, 3, or 4 peers) from academic area to area. Each period was 30 minutes long providing a balance between direct and indirect instruction (in which situation the child is encouraged to use materials the teacher presents in his own way). The level of the lesson is varied by the teacher to be appropriate for each small group. The morning small group learning periods consisted of language, reading readiness, and arithmetic and problem-solving areas.

During the fourth, fifth, and sixth learning periods the Peabody Language Development program was used. This involved about half of the children. The other half participated in reading, art, music, or self-directed activities.

The intent of the education program was to provide an environment and a set of experiences which would allow children to develop to their potential intellectually as well as socially, emotionally, and physically. The specific focus of the educational program was to prevent from occurring those language, problem-solving, and achievement motivation deficits which are associated with mild mental retardation and severe disadvantagement.

The general educational program is best characterized as having a cognitive-language orientation implemented through a structured environment by prescriptive teaching techniques on a daily basis (seven hours per day, five days per week). This program and schedule was coupled with a high teacher-child ratio, affording an opportunity to present a variety of cognitive tasks, to evaluate their effectiveness, and to provide both direct and non-direct teaching within both small and large groups.

PS 006644

Although there are many theories which have implications for an educational program; e.g., Skinner, Piaget, Montessori, Bruner; none is complete while all are relevant. By necessity the theory which has guided the development of the curriculum for the Milwaukee Project's Educational Program is eclectic yet structured in its presentation. There were no suitable programs available as guides for intervention in the first few months of life. Consequently, the project staff has continually adapted existing methods and materials for the purposes of our program.

The educational program had two major emphases: (1) language and (2) cognition. We considered language not only as essential to social communication, but essential to the ability to manipulate symbols, the tool by which one stores and recovers information and a major influence on how one interprets his environment. It was our intent that tasks or experiences be presented to the child with considerable emphasis on verbal expressiveness in order to facilitate this development.

The cognitive development of the children was of primary concern because we did not want to simply identify and provide children with those facts which are the supposed elements for success in school. A child must have at his disposal the technique not only to incorporate, integrate, refine, and utilize this information, but (and most importantly) to be able to act spontaneously whenever the situation changes.

Thus while a handle for the term cognitive development is difficult to find, there were certain identifiable developmentally important cognitive skills, e.g. classification, association, generalization, integration, interpretation. We have focused on these and have attempted to facilitate their development by incorporating into the educational program specific tasks, which were begun as soon as the children entered the program.

Importantly, although language was emphasized as a tool for processing information as well as for communication, and cognitive development was emphasized for the development of thinking creatively as well as providing the child with a repertoire of responses, we recognized that the energy to make this system work is the desire to utilize these skills. Therefore, a third area of concern was motivation. We attempted to develop achievement motivation by both designing tasks and creating an atmosphere which would maximize interest, provide success experiences, provide supportive and corrective feedback from responsive adults, and to gradually increase the child's responsibility for task completion.

The educational program took place within a structured learning environment. By utilizing a structured learning approach, the emphasis is on educating the teacher to plan and present relevant and organized learning situations. The content of instructional units was presented in small logical steps. The children's progress was evaluated and corresponding program adjustments made as part of an on-going process. Yet within this structured environment, we still emphasized flexibility as essential in order to meet the needs of the children and the teacher. Opportunities could be provided for both directed and non-directed instruction. There was greater opportunity for direct child-teacher intervention.

Thus the Milwaukee Project attempted to change the expected course of children who were at high-risk for mental retardation. The plan was to implement a comprehensive family intervention, beginning in the home.

The program for the retarded mothers was designed to modify those aspects of the environment which the mother herself creates or controls. Each day, her child was picked up at home and brought to the Infant Education Center for the entire day. These children are the Experimental group. The Control group are essentially the same kind of children whose mothers were in the original pool of High-Risk families from which were drawn both the Experimental and Control group families. The children in the Control group are seen only for testing, which is done on a prescribed schedule for both groups of children.

ASSESSMENT OF DEVELOPMENT

In order to assess the effects of the kind of comprehensive intervention we have made with the natural environment of

the infant reared by a retarded mother, we have undertaken an intensive schedule of measurements.[2] Our schedule of measurement includes measures of physical maturation, standardized and experimental measures of developmental schedules of infant adaptive behavior, standardized tests of general intelligence, an array of experimental learning tasks, measures of motivation and social development, and a variety of measures of language development.

Both the Experimental and Control infants are on an identical measurement schedule. Infants are scheduled for assessment sessions every three weeks. The particular measures administered at a given session depend upon the predetermined schedule of measures for that age level. A particular test or task is administered to both Experimental and Control infants by the same person; the testers are not involved in any component of the infant stimulation or maternal program.

In the first twenty-four months of life, the measurement schedule was largely restricted to general developmental scales and emerging vocalization and language.

Gesell Data:

The Gesell Developmental Schedules were administered to Experimental and Control infants at the ages of six, ten, fourteen, eighteen, and 22 months. Through six, ten, and fourteen month testings, both groups appeared reasonably comparable on the four schedules: Motor, Adaptive, Language, and Personal-Social. These data can be seen in the graph [Figure 2] which is a composite of the four schedules plotted in terms of the mean scale developmental age norms for each age level tested. There is some divergence in performance at fourteen months, due mainly to the significant ($p<.05$) difference on the Motor and Adaptive schedules in favor of the Experimental group. The Control group at this time also performs above average. At eighteen months the Control group began to fall three to four months below the Experimental group, although still performing at or close to Gesell norms. The Experimental group at eighteen months is significantly ($p<.001$) ahead of the Controls on all but the Personal-Social Gesell Schedule.

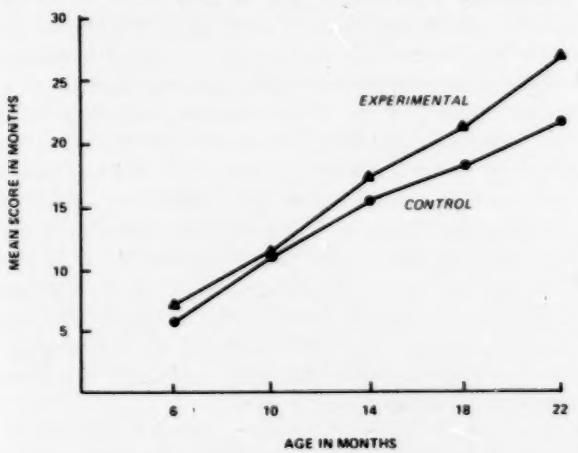


Figure 2. Composite of Four Gesell Scores

At 22 months the Experimental group scores are from four and one-half to six months in advance of the Control group ($p<.001$) on all four schedules, while the Control group has fallen below the Gesell norms on the Adaptive and Language schedules.

In summary, the Gesell data is roughly comparable for both groups to fourteen months with performance on all scales slightly in advance of test norms. At 22 months, performance of the Experimental group is clearly accelerated while the Control group performs at or slightly below norms for the four scales.

Learning:

Beginning at 24 months, increased emphasis was given to experimental, direct measures of learning and performance, as well as to the standardized tests of general intelligence.

The learning tasks chosen were those that, on the one hand, would characterize the developmental learning process and on the other hand were tasks that could be repeated yearly. By repeating tasks we could keep pace with the increasing CA's of our Ss and yet maintain a continuity of task which would permit evaluation of developmental changes in performance. *Obviously, the exceedingly complex nature of cognitive growth required more than a single measure of intellectual development, such as is obtained from IQ tests. Thus, a more comprehensive picture of the growth of cognitive abilities was attempted by an array of experimental learning tasks (see, e.g., Stevenson, 1972).*

Most importantly, we were concerned with delineating some of the characteristics of early learning behavior that are either facilitating or interfering with learning. We wanted information on the response patterns or behavior style, and we wanted information about the role of attention in early learning. These tasks, therefore, not only provided a measure of the differential development of the learning process in the children, but increased our understanding of how certain performance variables relate to cognitive growth.

One experimental task has been concerned with development of the child's attention to color and form and the response strategy employed. It is a color-form matching task in which the child may respond consistently according to one of the dimensions: color or form. He cannot respond consistently if he does not attend to one dimension or the other, especially if he uses a response strategy such as position responding or alternation responding. In this case, responding to the dimension of either color or form is more developmentally advanced than ignoring the color-form dimension and responding, e.g., to position. This test has been administered four times. During the third year of life, none of the Controls demonstrated a dimensional response (i.e., in terms of color or form). By contrast, over half of the Experimental group (55 percent) showed unidimensional responding. In the fourth year of life and during the fifth and sixth years as well, this differential performance was maintained. There are two notable points: (1) three-fourths or more of the Experimental group showed

unidimensional responding at each successive testing, while even at the fifth and sixth year testings the percentage of the Control group showing unidimensional responding was comparable only to the Experimental group's first test performance, nearly two years before; and (2) the Experimental group showed a significant shift to form, which is quite consistent with other research indicating advanced developmental performance. Quite interestingly, of those children in both groups who did not show dimensional preference, by far a greater percentage of the Controls, at each testing, showed response perseveration. In other words, little or no attempt is made, it seems, to attend to either color or form since most (over two-thirds) responses were made purely to position. As of the last testing (when children are between the ages of five and six) only twenty percent of the Experimentals showed such responding, as compared to nearly two-thirds of the Control group.

Additional evidence for perseverative responding and the development of strategies was gained from a probability learning task. In this task no response is always correct, but a strategy of responding can help to increase the child's percentage of payoff. In fact, although both groups were reinforced at about the same rate (i.e. payoff)—they were very different in their use of strategy. The Control group showed a greater tendency to perseverate, i.e., they continued to respond to either a stimulus or position irrespective of the consequence of their previous response. Further, whereas only one-third of the Experimental group showed a tendency to perseverate, 80 percent of the Controls perseverated. By the second testing, nearly two years later, nearly three-fourths of the Control children continued to perseverate as compared to only one-fourth of the Experimental group. This tendency to perseverate suggests that the children are insensitive to the reinforcement contingencies—i.e., they do not seem to appreciate the feedback to be gained from their response and therefore perseverate their response to position.

Thus, we feel that in spite of the apparent simpleness of these tasks, they demonstrate the association of early intellectual development with an ability to impose order on the environment—an ability which is basic and essential to intellectual development. This difficulty in the performance of various learning tasks may be similar to the input phenomena found in studies of short-term memory (Calfee, 1969). In that kind of an experimental paradigm, and perhaps in ours as well, there appears to be a critical lack in the ability to organize stimulation for input where there is sub-average intellectual functioning.

A deficiency in this critical ability becomes quite apparent in the performance of various problem-solving and concept formation tasks. For example, we have studied the performance of the children in an oddity discrimination task. The child is presented with a horizontal array of three stimuli, each of which has four component dimensions: color, form, size, and number. In order for the child to be able to select the odd stimulus on each trial, he must first separate the dimensions into relevant, irrelevant, and quiet. This is an extremely complex conceptual task for very young children.

This task has been presented three successive times, and the data shows superior performance by the Experimental children. We have analyzed the data further by a breakdown of the concept categories. These results show a superior performance on all dimensions and particularly on the form dimension for the Experimental children, which is consistent with their performance on our most recent replication of the matching study. Obviously this preference can facilitate performance, but it is just this point that underscores our earlier remark regarding the development of attentional processes. Though it may be that dimensional preferences lead in some situations to response biases, it can also index the developmental process of selective organization of the stimulus environment, especially for very young children. The earlier that such behavior occurs, the greater the facilitation of learning performance on just such kinds of tasks. In our case, the data points obviously to a developmentally related facilitation of performance as a function of the degree to which the early dimensional preferences have been established.

Language Development:

A child's acquisition of language occurs in a surprisingly short period of time. Although grammatical speech rarely begins before eighteen months of age, the basic process appears complete by the age of three and one-half. Furthermore, at this age level, it is probably language facility which most clearly differentiates the cultural-familial retardate from his non-retarded peers. It is for this reason that we have given so much emphasis to both the development of the children's language abilities and the measurement of this aspect of behavior. Our concern is both with the quantitative and qualitative differences in the developing language structures of these two groups.

The development of language depends on a number of organic and environmental factors. The main variable in the social environment critical to language development in the child is the primary responsible adult: usually the mother. Brown and Bellugi (1964) suggest three processes operating in the learning of language. The first process is one of imitation with reduction by the child of the adult utterances in the environment. The young child seems to reduce adult utterances to a form which is much like that of a telegram; i.e., it utilizes the high content, low-function words of the adult utterance. Thus, where an adult might say something like, "I see the big chair," the child might say, "See chair." This telegraphic language can communicate a situation known to the adult and the child.

The second process appears to involve the imitation of the child's utterances by the adult. What might happen is, when a child says something, the adult repeats the utterance and expands it slightly. The resulting utterance is a perfectly formed model sentence in the adult language which apparently has, as its purpose, the effect of saying to the child, "This is the way you could have said what you just said." Thus, where a child might say something like,

"There doggie," the adult might say, "Yes, there is a doggie." This type of imitation occurs in about 30 percent of the utterances.

The third process is one of induction of the latent structure: this requires that the child learn the rule of language, which he appears to do in some covert manner. The basic learning of the language system is usually complete by the time the child enters school. It is obvious, therefore, that if the responsible adult in a child's environment is language deficient and somewhat nonresponsive, there can be serious retardation in a child's language development.

The first statistically significant difference in language development appeared at eighteen months on the Language scale of the Gesell Developmental Schedule. At this testing age the Experimental children were two months above the norm and three months ahead of the Controls. By 22 months the Experimental children were over four months ahead of the norm and six months ahead of the Controls. This trend of differential language development has continued, and perhaps in even a more dramatic way. In fact, some of the most striking differences in the performance of the Experimental and Control children are reflected in the research measures of language performance.

Research in developmental psycholinguistics usually divides language into three areas: imitation, comprehension, and production. We are using both tests developed in our laboratory and such standardized instruments as the ITPA, in order to assess language development. Imitation, the child's ability to repeat certain grammatical structures presented to him as models, is tested through a sentence repetition test; comprehension, the understanding of grammatical structures, is assessed through a grammatical comprehension test; while production, spontaneous language facility, is measured through gross feature tabulation of free speech samples. Together, the results of these measures have provided us with a comprehensive picture of the children's language development for five years.

Samples of conversation between each child and our language tester (a black middle-aged woman) have been analyzed since the child's eighteen month birthday. The free speech sampling technique is quite useful with such young children since the situation is relaxed, unstructured, and the child is quite comfortable in conversation. Structured test situations, on the other hand, particularly at these very early ages, tend to restrict the behavior of the child and thereby reduce the validity of the speech sample somewhat.

The analysis of this language sample indicated that the Experimental children between the ages of one and one-half and three say a lot more in conversation. Using this measurement technique, we find that it is not until three years of age that the Control group produces the same amount of utterances as the Experimental children. However, since the measure provides a rather gross picture of language as language becomes more complex, it actually masks the considerable linguistic differences that exist between the children. These differences show up in the group's performance on the more sophisticated language measures.

Still, we feel that this considerable early difference in language behavior is basic to the more sophisticated language skills yet to come. We are not quite sure why, but the repetition and verbal expressiveness characteristic of the Experimental group between one and one-half and three seems fundamental to the continued differential development of language skills by the E group over the C group. The amount of utterances at the eighteen month level for the Experimental group is not achieved by the Control group until nearly a year later.

The mean number of unique words, lexical growth in free production, was also measured. Vocabulary range is always greater on the part of the Experimental group. This is so even when the Control group produces more utterances than the Experimental group; the Experimental group still produces more unique words.

At the age of three we began to test imitation by means of a sentence repetition test. It's an easily administered instrument: you ask the child to repeat what the tester says. The children's replies are analyzed for omissions, substitutions, and additions. The omissions are significantly greater for the Control group at every age level from 36 months on while there is a significant decrease in omissions by the Experimental group every six months. Also, the Experimental group has made significantly fewer substitutions and additions to the repetitions. The Experimental group by the age of four has significantly more exact repetitions than the Control group, whose performance is comparable to the Experimental group's performance at three. This same performance differential continues through age five.

Also at age three we tested grammatical comprehension with a modified version of a test developed by Dr. Ursula Beliugi-Klima (Fraser, 1963). It is a game in which the child manipulates objects in order to demonstrate his ability to comprehend various grammatical constructions, such as the active and passive voice. In this test you might have, for example, two toy animals and you ask the child to show 'the pig chases the cow' and then you ask the child to show you 'the pig is chased by the cow. The child is expected to act out these situations, which requires just comprehension, not production. The game is played with the child across sixteen syntactic areas: e.g., active-passive voice, embedded sentences, singular-plural, possessive nouns, and prepositions. The results show that the Experimental group's performance is significantly superior at all age levels tested (three, four, and five). Their grammatical comprehension is at least one year (and more) in advance of the Control group.

Our standardized language instrument has been the ITPA, which has been administered to all children over four and one-half. The results have, basically, supported the differential performance of the Experimental and Control groups on our other measures. The mean psycholinguistic age of the Experimental group is 63 months (measured at 54 months) as compared to a mean of 45 months for the

Control group, a difference in favor of the Experimental group by over a year and one-half.

In describing the language behavior of the Experimental children one would find them voluably expressive, verbally fluent, and according to the ITPA linguistically sophisticated. They speak their own dialect and they are proud of their own speech and yet their performance is developmentally advanced on sophisticated tests of the English language.

Mother-Child Relationship:

Each mother, especially if she is retarded, creates an environment for her child which is quite different from that created by other mothers, even though all live in the same environment. Indeed, it is the very nature of the environment created by the mother which influences social, emotional, and cognitive development. The investigation of this relationship has been studied in detail by Hess and Shipman (e.g. 1968). They found that the mother's linguistic and regulatory behavior induces and shapes the information processing strategies and style in her child and can act to either facilitate or limit intellectual growth.

Mildly retarded mothers tend to regulate behavior by using imperatives and restricted communication – a benavior control system which can stultify intellectual growth in her child. Furthermore, the nature of this interaction is such that it induces a passive-compliant attitude by weakening the child's self-confidence and dampening motivation. We were quite concerned, therefore, in determining the nature of the mother-child relationship, especially after having intervened in this critical process.

In the mother-child interaction most sophisticated behavior – such as the initiation of problem-solving behavior by verbal clues and verbal prods, or the organization of tasks with respect to goals in problem-solving situations, etc. – is done by the mother. However, where the mother is of low IQ, the interaction is more physical, less organized, and less direction is given to the child. Indeed, while this was the case in the Control group mother-child dyads, it was quite different in the Experimental dyads.

We used a specially prepared mobile laboratory for all experimental sessions. The testing room was equipped with videotape and sound recording equipment, so that the entire session with each family was recorded for later analysis. The mother and child are brought to the laboratory and seated at a table. Part of this research involved explaining to the mother the tasks she and the child were to perform. First she was to tell the child a story based on a picture, which afforded us the opportunity to measure the mother's language facility. Second the mother was told to teach the child a block sorting task and how to copy three designs on a toy Etch-A-Sketch. The behavior between the mother and child was rated on a scale with rating categories divided into various kinds of physical and verbal behaviors, with additional categories to indicate whether the behavior was active or passive.

We found that the Experimental dyads transmitted more information than the Control dyads, and this was a function of the quality of the Experimental child's verbal behavior. The Experimental children supplied more information verbally and initiated more verbal communication than found in the Control dyads. The children in the Experimental dyad took responsibility for guiding the flow of information – providing most of the verbal information and direction. The mothers of both dyads showed little differences in their teaching ability during the testing session. However, in the Experimental dyads, the children structured the interaction session either by their questioning or by teaching the mother. As a result, a developmentally more sophisticated interaction pattern has developed between the Experimental children and their mothers, which contributed to faster and more successful problem completion.

It is apparent from this description of a portion of the data of the mother-child interaction, that the intervention effort has effectively changed the expected pattern of development for the Experimental dyads. Moreover, the result of what might be termed a reciprocal feedback system, initiated by the child, has been to create a more sophisticated and satisfying interaction pattern in the Experimental dyad. In fact, there is some evidence that the Experimental mothers may be undergoing some changes in attitude and self-confidence. The Experimental mothers appear to be adopting more of an "internal locus of control" – an attitude that 'things happen' because of their decisions and actions and not purely by chance or fate. Thus, the intensive stimulation program, undergone by the Experimental children, has benefitted both the Experimental child and the Experimental mother by broadening their verbal and expressive behavioral repertoire.

Measured Intelligence to 66 Months:

The standardized tests of intelligence included the Cattell, Stanford-Binet, and the WPPSI. The Cattell test, extending into the Binet, was scheduled at three month intervals beginning at CA 24 months and at six month intervals from CA 48 months on. The graph illustrates the course of intellectual development for the two groups from twelve months until 66 months of age. The data presented uses scores derived from the Gesell schedules from 12 to 21 months, and Cattell and Binet scores from 24 to 66 months. The mean IQ at the upper age level of 66 months is based on approximately half of the group, because at this time not all of the subjects have reached this age.

The mean IQ for the Experimental group based on the means at each age interval from 24 to 66 months is 123.4. For the Control group, mean IQ for all testings is 94.8. At the latest age point the Experimentals are just above their mean, at 125 (s.d. = 8.5) while the Controls have slipped below their overall mean to 91 (s.d. = 9.1). The discrepancy between Experimental and Control group performance at each three month test interval varies from a minimum of 23 IQ points at 24 months to over 30 IQ points at 66 months.

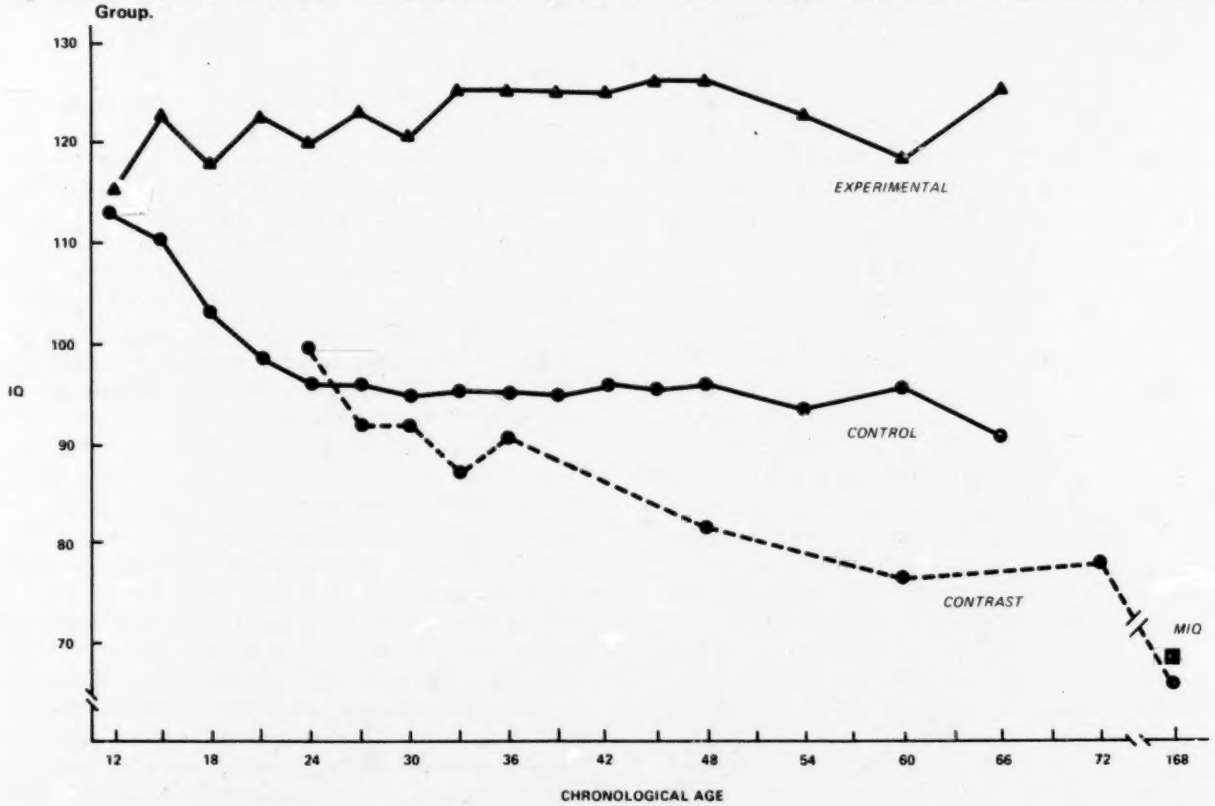
These data summarize the present differential development between the Experimental and Control groups. The dotted line on the graph [Figure 3] represents the mean IQ's of offspring of mothers with IQ's below 75, taken

from our original population survey. This is referred to in our study as the Contrast group. It depicts the pattern of development expected for our actual Control group. You will recall that our hypothesis was in terms of preventing the relative decline in development of the Experimental group which we see in the Contrast group and which we can begin to see in the Control group. In sharp contrast is the Experimental group's performance, to date, on the standardized tests of measured intelligence, indicating a remarkable acceleration of intellectual development on the part of these children exposed to the infant stimulation program. Further, their performance is quite homogeneous as contrasted with that of the Control group where less than one-fourth of the Ss test at or above the norms with the remainder trending toward sub-average performance.

It is important to point out that there is reason for caution in the interpretation of such data, particularly when one considers the numerous pitfalls and hazards of infant measurement. The Experimental children have had training, albeit fortuitously, on items included in the curriculum which are sampled by the tests, while the repeated measurements have made both groups test-wise. It is well to point out, however, that curriculum materials and tests used are standard fare for early education programs everywhere. All in all, it does seem that the Experimental group has benefitted from the intensive training program, a program to which no comparable group of infants has ever been exposed, to the best of our knowledge. We have tried very hard to answer whether it has been simply a matter of training and practicing specific skills. In fact, extraordinary precaution has been taken to separate the development of the curriculum and the assessment program. Two separate staffs have been employed. It is obvious to most researchers that, to some extent, infant intelligence tests must contain material which approximates material used in preschool curricula, primarily because of the limited variety of material for this age. To circumvent this problem somewhat, we have employed other measures of performance, which minimized the stock item, and thereby afforded additional insight into the differential development of these children. As could be seen in the measures of learning and language development, the differential performance discrepancy is consistent with the IQ measures, indicating advanced intellectual development of the Experimental group. What is more, there is considerable difference in the pattern or style of behavior between the groups — particularly the tendency to stereotypy of response exhibited by the Control group, which certainly is antagonistic to successful learning performance.

Thus, infant testing difficulties notwithstanding, the present standardized test data, when considered along with performance on learning tasks and language tests, indicate an unquestionably superior present level of cognitive development on the part of the Experimental group. Also, the first "wave" of our children are now in public schools. *None* have been assigned to classes for the retarded and we are collecting data on school performance generally.

Figure 3. Mean IQ Performance with Increasing Age for the Experimental and Control Groups in Comparison to the High Risk Survey Contrast Group.



CONCLUSION

We were particularly concerned with the social-emotional development of our children, which was encouraged through the interpersonal relationship developed between the teachers and the children and their families. We felt that this was fundamental to developing intellectual strength in children. Intellectual strength we defined as the ability to meet new experiences with not only considerable creativeness and ingenuity, but with self-confidence and the kind of motivation that is based on the natural curiosity to learn. The child who feels himself to be intellectually strong enters new learning situations with eagerness, unafraid of failure, and filled with curiosity and excitement with each new adventure in knowledge gathering. Unfortunately, this natural desire to pursue and discover and learn about our world, that is within each of us, can be dampened or shut down by negative learning experiences. In all too many cases a child's failure to learn is due to the restricted learning environment created for him in early life. As a result, children who have such developmental histories develop a behavior system which is antagonistic to the learning they must do for successful school performance.

Learning need not be forced if there is excitement. Experiences must not be restricted, opportunities for learning must be varied, solutions must have alternatives, and discovery must be shared in. The environment for preschool age children must be at once so rich, so varied, so intriguing, and so organized that a child has before him considerable opportunity to learn and make use of his own natural tendencies to discover.

It appears, however, that the mitigation of the environmental influences for which cultural-familial retardation is a consequent can be accomplished, though not by any single source. Most importantly, though, help must be given to that large population of mothers who are unaware of the critical nature of early childhood and also unaware of their own needs during pregnancy. *In large part, it is these mothers who consequently contribute to the growing number of children so poor in development that they are at high risk for mental retardation.* Therefore, existing early stimulation programs notwithstanding, there is considerable need for a comprehensive, nation-wide program for the prevention of mental retardation. The implementation of this program with any consideration for success will require an active community service program for which there probably is no previous model, but there is now available information of the kind we have just presented to you. Indeed, if our country is to seriously challenge the problem of cultural-familial retardation, we must do so at its doorstep and that will require a strategy for prevention, with increased emphasis on early detection and early intervention.

Footnotes

[1] The Milwaukee Project has been supported in part by Grant 16-P-56811/5-07, to Dr. Rick Heber, Director of the Milwaukee Project, from the Rehabilitation Services Administration of the Social and Rehabilitation Service of the Department of Health, Education, and Welfare.

[2] Because of the obvious limitations of this report, only a portion of the measurements are reported here.

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